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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/033,644	12/27/2001	Katrina Mikhaylichenko	LAM2P316	7982

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EXAMINER

NGUYEN, KHIEM D

ART UNIT PAPER NUMBER

2823

DATE MAILED: 08/06/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

10/033,644

Applicant(s)

MIKHAYLICHENKO ET AL.

Examiner

Khiem D Nguyen

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 20 May 2003.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-24 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-24 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 27 December 2001 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on _____ is: a) ☐ approved b) ☐ disapproved by the Examiner.
If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
* See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- 1) ☐ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____.
- 4) ☐ Interview Summary (PTO-413) Paper No(s) _____.
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other:

DETAILED ACTION

Response to Amendment

Response to Applicant's Arguments

Applicant's arguments filed 05-20-2003 have been fully considered but they are not persuasive.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 1-24 are rejected under 35 U.S.C. 103(a) as being unpatentable over the Applicant's Admitted Prior Art (AAPA) in view of Vyvoda et al. (U.S. Pub. 2002/0105057) and Yoon (U.S. Pub. 2002/0090784).

AAPA teaches plasma etching a feature 17 into a low K dielectric layer 16 having a photoresist mask 18, the plasma generating etch residues 22 in and around the feature (page 1, line 20 to page 2, line 17 and FIG. 1A); and

Ashing the semiconductor wafer to remove the photoresist mask, the ashing generating ashing residues 27 (page 2, line 18 to page 3, line 4 and FIG. 1B);

AAPA discloses (page 3, lines 5-12) removing the etching residues and the ashing residues from the low K dielectric layer by moving the wafer into the chemical bath containing liquids but fails to teach removing being enhanced by scrubbing the low K dielectric layer of the semiconductor wafer with a wet brush that applied a fluid mixture

including a cleaning chemistry and a wetting agent wherein the wetting agent is a surfactant and the cleaning chemistry includes a combination of NH_2OH , H_2O_2 , and deionized (DI) water as recited in present claims 1, 2, 9, 11, 17, 18 and 24.

Vyvoda teaches removing the residues (page 2, paragraph [0019]) from the low K dielectric layer (page 2, paragraph [0020]), the removing being enhanced by scrubbing the low K dielectric layer of the semiconductor wafer with a wet brush (page 2, paragraph [0021]) that applies a fluid mixture including a cleaning chemistry (standard clean SC1) solution including a combination of NH_2OH , H_2O_2 , and deionized (DI) water (page 1, paragraph [0004]). It would have been obvious to one of ordinary skill in the art of making semiconductor devices to incorporate Vyvoda's teaching into AAPA's method in order to provide a wafer surface comprising semiconductor and dielectric that attracts enough water to allow the wafer surface to wet so that the residual slurry particles and metal contaminants may be removed therefrom (page 1, [paragraph 0009]).

Neither AAPA nor Vyvoda discloses wherein the surfactant is selected from a group comprising fluorosurfactants and hydrocarbon surfactants as recited present claims 3, 12, and 19.

However, the use of a surfactant selected from a group comprising fluorosurfactants and hydrocarbon surfactants is well-known to one of ordinary skill in the art of making semiconductor devices. It would have been obvious to one of ordinary skill in the art of making semiconductor devices to incorporate the known process into AAPA and Vyvoda's method to enable provision of the surfactant of AAPA and Vyvoda's.

Neither AAPA nor Vyvoda discloses the percent by weight range of the surfactant concentration as recited in present claims 4, 5, 13, 14, 20 and 21.

However, there is no evidence indicating that the percent by weight range of the surfactant concentration is critical and it has been held that it is not inventive to discover the optimum or workable ranges of a result-effective variable within given prior art conditions by routine experimentation. See MPEP 2144.05.

Neither AAPA nor Vyvoda disclose the range of the combination ratio of NH_2OH , H_2O_2 , and deionized (DI) water as recited in present claims 6, 7, 15, 16, 22, 23 and 24.

Yoon disclose (page 4, paragraph [0048]) wherein the combination ratio of NH_2OH , H_2O_2 , and deionized (DI) water is about 1:4:20. It would have been obvious to one of ordinary skill in the art of making semiconductor devices to incorporate Yoon's teaching into AAPA's and Vyvoda's method in order to completely remove the damaged layer and the plate-shaped defect (page 4, paragraph [0048]).

Response to Amendment

Response to Applicant's Arguments

Applicant's arguments filed 05-20-2003 have been fully considered but they are not persuasive.

In response to Applicant's argument that none of the cited prior art references discloses or suggests removal of etching residues and ashing residues from a low K dielectric layer using a scrubbing action with a cleaning chemistry and a wetting agent, examiner disagree, the Applicant's Admitted Prior Art (AAPA) discloses plasma etching

a feature 17 into a low K dielectric layer 16 having a photoresist mask 18, the plasma generating etch residues 22 in and around the feature (page 1, line 20 to page 2, line 17 and FIG. 1A), ashing the semiconductor wafer to remove the photoresist mask, the ashing generating ashing residues 27 (page 2, line 18 to page 3, line 4 and FIG. 1B), and removing the etching residues and the ashing residues from the low K dielectric layer by moving the wafer into the chemical bath containing liquids (page 3, lines 5-12), Vyvoda discloses removing the residues (page 2, paragraph [0019]) from the low K dielectric layer (page 2, paragraph [0020]), the removing being enhanced by scrubbing the low K dielectric layer of the semiconductor wafer with a wet brush (page 2, paragraph [0021]) that applies a fluid mixture including a cleaning chemistry (standard clean SC1) solution including a combination of NH_2OH , H_2O_2 , and deionized (DI) water (page 1, paragraph [0004]). Thus, it would have been obvious to one of ordinary skill in the art of making semiconductor devices to incorporate the residues removal technique of Vyvoda into AAPA's method in order to provide a wafer surface comprising semiconductor and dielectric that attracts enough water to allow the wafer surface to wet so that the residues may be removed therefrom (page 1, [paragraph 0009]).

Conclusion

THIS ACTION IS MADE FINAL. Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire **THREE MONTHS** from the mailing date of this action. In the event a first reply is filed within **TWO MONTHS** of the mailing date of this final action and the advisory action is not

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mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Khiem D Nguyen whose telephone number is (703) 306-0210. The examiner can normally be reached on Monday-Friday (8:00 AM - 5:00 PM).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Olik Chaudhuri can be reached on (703) 306-2794. The fax phone numbers for the organization where this application or proceeding is assigned are (703) 746-9179 for regular communications and (703) 746-9179 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 308-0956.

K.N.
July 30, 2003



Olik Chaudhuri
Supervisory Patent Examiner
Technology Center 2800